A NOTE ON HENNING'S SMELL SERIES

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Henning[1] has given us a thorough discussion of his researches in smell so far as their historical and theoretical aspects are concerned. As Gamble[2] has already pointed out, however, the details of experimentation are very meager. Henning's most striking contribution is, probably, his serial classification of odors; yet nowhere does one find listed the qualities of any considerable part of the 415 stimuli[3] used. At most there are examples of several of the series from the reports that one or another *O* gave; but these examples vary greatly in completeness and, by Henning's own profession, are not unequivocal, but differ from time to time and from *O* to *O*. Anyone who has attempted to make a class-demonstration or an elementary laboratory experiment based on the new classification of odors has come upon these difficulties.

We have attempted to supply in some measure the data which Henning has omitted. Following the example of others[4] we have accepted the Henning prism as a starting-point. From the sample lists of the several series which Henning gives, we have taken all those stimuli that can be readily obtained, 75 in number. Small quantities of the substances were placed in two-drachm bottles which were numbered on the side and on the cork There was no marking on the bottles which could give the *O*s a cue to the nature of the contents, and the numbered labels practically concealed them.

The *O*s knew to start with the general nature of Henning's classification, and they had been given Henning's typical corner odors. Every *O* was required to make one complete classification of the entire set. He was instructed to "choose at random ten stimuli; to smell them one at a time with both nostrils; and to record every particular number under the group heading or headings that best described the odor." Not more than 10 stimuli were smelled at a sitting. The *O*s were, in the main, members of an advanced class which had just taken up the systematic study of olfactory sensation, and of an elementary laboratory class. A few well trained *O*s were included. A total of 16 classifications was made. The first classification made by every *O* is the one taken for our results, inasmuch as our purpose is to find a set of odors that will illustrate the series unequivocally and immediately.

In Table I we have brought together the results of the 16 classifications. In the second column, under H, the designations indicate the approximate classification of the odors according to Henning[5]. The numerical results show the distribution of the classifications made by our *O*s. The greatest number of choices that can be made under a single heading is 16, but a greater total number for a single stimulus may result from its classification as an intermediate odor.

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[1]H. Henning, *Der Geruch*, 1916. Printed earlier in the *Zeit. f. Psychol.*, 73-76, 1915, 1916, in four parts.

[2]E. A. Mc. Gamble, this JOURNAL, 32, 1921, 290.

[3]Henning, *op. cit.*, 7.

[4]Gamble, *op. cit.*; E. B. Titchener, this JOURNAL, 31, 1920, 213.

[5]*Op. cit.*, 80-97.

TABLE I

Stim	H	Fl	Fr	Sp	Re	Bu	Fo	Stim.	H	Fl	Fr	Sp	Re	Bu	Fo
Vanilla	Fl	6	11	6	1	1	—	Acetic Ether	ReFr	3	6	—	9	3	2
Jasmine oil	Fl	15	1	—	—	—	—	Ethyl Ether	ReFr	5	5	—	8	2	—
Tonka Bean	Fl	8	—	9	—	—	—	Acetone	ReFr	2	6	2	9	3	1
Apple Blossom*		16	—	—	—	—	—	Collodium	ReFr	1	7	1	9	5	—
Camomile fl.	FlSp	5	—	14	—	2	—	Lemon o.	Fr	—	16	—	1	—	—
Lavender fl.	FlSp	6	6	12	1	—	—	Orange o.	Fr	5	14	—	1	—	—
Origanum o.	FlSp	1	4	3	14	5	—	Citronella o.	Fr	5	6	3	6	2	—
Arnica tin.	FlSp	1	11	2	3	9	—	Bergamot o.	Fr	—	3	4	11	—	3
Hops fl.	FlSp	1	—	8	1	2	9	Amyl-Valerate	Fr	—	15	—	1	—	—
Cumarin	FlSp	10	7	4	1	—	—	Geranium o.	FrFl	9	6	6	6	1	—
Caraway o.	FlSp	1	4	6	6	1	2	Pyridine	Bu	—	—	—	—	8	14
Clove o.	FlSp	3	4	12	2	—	—	Tar	Bu	—	—	—	—	14	2
Bay o.	FlSp	7	5	9	3	—	—	Coffee	BuSp	—	—	9	—	7	—
Thyme fl.	FlSp	3	—	13	—	—	—	Xylol	BuRe	1	1	1	11	6	—
Cassia o.	FlSp	3	3	14	—	—	—	Toluol	BuRe	1	—	1	11	5	2
Pepper	Sp	1	—	14	2	—	—	Benzol	BuRe	1	3	—	9	3	4
Sage	Sp	6	1	11	2	—	1	Fish Soap	Fo	—	—	—	1	3	15
Cinnamon	Sp	1	1	16	—	—	—	Glue	Fo	—	—	—	1	3	16
Ginger	Sp	8	6	5	6	—	—	H_2S†	Fo	—	—	—	1	—	15
Anise o.	SpRe	6	13	8	—	—	—	Ammon.-Valer.*		1	8	1	2	1	7
Marjoram	SpRe	3	—	11	2	—	—	Lactone	FoBuSpFl	4	1	5	2	—	4
Sassafras o.	SpRe	4	8	10	3	—	—	Apiol	FoBuSpFl	2	3	5	5	9	—
Nutmeg o.	SpRe	1	3	12	2	—	2	Asafoetida	FoBuSpFl	—	—	—	1	1	15
Fennel o.	SpRe	4	8	7	7	—	—	Celery Seed	FoBuSpFl	2	2	12	1	—	—
Cardamom	SpRe	2	4	10	8	1	—	Dill Seed	FoBuSpFl	3	1	13	2	—	—
Canada Bal.	Re	2	1	—	11	1	1	Mustard oil	FoBuSpFl	—	3	6	4	—	10
Cedar o.	Re	1	1	4	12	2	1	Guiacol	FoBuSpFl	2	—	—	2	14	—
Juniper o.	Re	—	4	3	11	1	—	Musk Root e.	FoBuReFr	10	—	2	2	4	2
Pine Need. e.	Re	—	1	4	12	—	—	Musk	FoBuReFr	1	5	6	5	6	2
Sandarak g.	Re	2	3	1	9	—	1	Arbor Vitae e.	FlFrSpRe	2	6	4	7	3	—
Spikenard o.	Re	—	2	—	14	2	—	Juniper Ber.	FlFrSpRe	3	3	7	3	1	—
Camphor g.	Re	—	1	5	10	—	—	Tansy o.	FlFrSpRe	3	—	8	9	5	—
Myrrh tin.	Re	4	6	4	3	5	—	Wormwood o.	FlFrSpRe	2	1	8	6	5	1
Turpentine	Re	1	—	—	15	2	—	Peppermint o.	FlFrSpRe	3	6	10	6	—	—
Cajuput o.	Re	—	2	4	13	—	1	Spearmint o.	FlFrSpRe	4	9	6	4	—	1
Rosemary o.	Re	—	4	5	12	—	—	Menthol	FlFrSpRe	—	5	10	3	3	1
Eucalyptus o.	Re	—	1	4	12	—	4	Amyl-acetate*		2	16	—	—	—	4
Lavender o.	Re	3	5	4	9	—	—								
Copaiba Bal.	Re	5	2	9	4	1	—								

Fl = flowery; Fr = fruity; Sp = spicy; Re = resinous; Bu = burned; Fo = foul; fl. = flowers; o. = oil; g. = gum; tin.. = tincture; e. = extract; Bal. balsam; *not classified by Henning; † add a few drops of Hydrochloric Acid to Ammonium Sulphide.

It is evident from the table that valid examples of corner and intermediate odors can not be taken at random from the sample series of Henning. For example *vanilla*, which Henning gives as characteristically flowery, is designated more frequently by our *O*s as fruity; *tonka-bean* is as spicy as it is flowery; while *jasmine oil* is always flowery. There are many similar cases, especially among the intermediate odors. This same multiplicity of similarities is also remarked by Henning[6], and indeed is the basis of his conception of the Smell Prism as a surface figure[7].

Adequately to demonstrate the odor series, then, it is obviously necessary to select those odors which will fall most readily into their proper classes. We have attempted to do this in Table II. In it we have included under the proper headings (1) those stimuli which in at least 70% of the cases our *O*s classify in the same way as Henning, (2) in parentheses those stimuli in whose cases our *O*s do not agree so well with Henning, but are still not at total variance with him, and (3) in italics those stimuli in whose cases our *O*s totally disagree with Henning, but agree significantly among themselves.

TABLE II

Flowery	Fruity	Spicy	Resinous	Burned	Foul
Jasmine o. *Apple Blos.*	Lemon o. Orange o. Amyl-Valerate	Cinnamon Pepper Camomile f.	Spikenard o. Turpentine Cedar o. Pine-Needles Rosemary o. Eucalyptus o. Cajaput o.	Tar *Guiacol*	Fish Soap Glue H_2S *Asafoetida*
Fl-Sp	Sp-Re	Re-Fr	Re-Bu	Fr-Fo	Fr-Fl
Lavender f. Cumarin Cassia o. Clove o. Bay o. *Tonka-bean*	Marjoram Cardamom Nutmeg Sassafras o. Anise o.	Acetic Ether Ethyl Ether Acetone Collodium	Xylol Toluol	*Ammonium-Valerate*	*Orange o.* *Vanilla*
Bu-Sp	Fo-Bu	Fl-Fo	Sp-Re-Bu	Fl-Fr-Fo	
Coffee	*Pyridine*		*Tansy o.* *Wormwood o.*	*Amyl-acetate*	
Fl-Fr-Sp-Re	Fl-Sp-Bu-Fo	Fo-Bu-Re-Fr			
Arbor Vitae Juniper ber. Peppermint o. Spearmint o. *Myrrh*	(Apiol) (Lactone) (Mustard o.) *Hops f.*	*Benzol* (Musk)			

The foregoing table shows the stimuli which may be depended upon to demonstrate every corner, every edge (with one exception), and every surface of the smell prism. The stimuli, in the classification of which we agree with Henning, are to be preferred. Those in italics can be seen by reference to Table I to have been very positively placed by our *O*s and are therefore dependable. We have made no attempt as yet to arrange the intermediate odors serially between end-points. As Henning[8] remarks, a large number of intermediate steps is necessary to demonstrate adequately a psychological series. We hope to be able to duplicate and add to Henning's complete list of stimuli and to make out their serial arrangement.

[6] *Ibid.*, 97.
[7] *Ibid.*, 97.
[8] *Ibid.*, 500.